

DETAILED ACTION

Claim Objections

Claim 21 is objected to because of the following informalities: As amended claim 21 contains two periods; one after step c, and one after step e. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11 Claims 5-7, 15-17, 22 are rejected under 35 U.S.C. 112, second paragraph, as
12 being indefinite for failing to particularly point out and distinctly claim the subject matter
13 which applicant regards as the invention.

15 Claims 5-7, 15-17, 22 contain steps d and e. however, these steps are already
16 present in claims 1, 13, 21, from which these claims depend.

Claim Objections

Allowable Subject Matter

20 Claims 5-9, 15-17, 22 are objected to as being dependent upon a rejected base
21 claim, but would be allowable if rewritten in independent form including all of the
22 limitations of the base claim and any intervening claims.

1 ***Claim Rejections - 35 USC § 103***

2 The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all
3 obviousness rejections set forth in this Office action:

4 (a) A patent may not be obtained though the invention is not identically disclosed or described as set
5 forth in section 102 of this title, if the differences between the subject matter sought to be patented and
6 the prior art are such that the subject matter as a whole would have been obvious at the time the
7 invention was made to a person having ordinary skill in the art to which said subject matter pertains.
8 Patentability shall not be negated by the manner in which the invention was made.

9
10 Claims 1-4, 12-14, 18, 19, 21, are rejected under 35 U.S.C. 103(a) as being

11 unpatentable over Leinberger et al. as shown in (Multi-Capacity Bin Packing Algorithms
12 with Applications to Job Scheduling under Multiple Constraints), in view of Walser (US
13 6,031,984)

14 With respect to claim 1, 13, 19, 21, Leinberger teaches; assigning objects to
15 processing units of a cluster of processing units, each one of the objects having an
16 object size and an object load, ("In general, the d-capacity bin-packing algorithms are
17 extensions of the single capacity bin-packing algorithms" page 4, paragraph 1) each
18 one of the processing units having a storage capacity and a load capacity, the method
19 comprising:

20 a) calculating an index based on object size and object load for each one of the objects,
21 ("In the d-capacity formulation, however, the items are sorted based on a scalar
22 representation of the d components." page 5 paragraph 4)
23 b) sorting the objects by index to provide a sequence of objects; ("First-Fit Decreasing
24 (FFD) first sorts the list L in non-increasing order and then applies the First-Fit packing
25 algorithm." page 5 paragraph 4)
26 c) for each processing unit of the cluster: ("In past massively parallel processing

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- 1 systems, such as the TMC CM-5 and the CRI T3E, the scheduling problems consisted
- 2 of allocating a single type of resource among the waiting jobs; the processing node. A
- 3 Job was allocated the minimum number of nodes required to meet its largest resource
- 4 requirement (e.g. memory, CPUs, I/O channels, ect.)." Leinberger Abstract)
- 5 assigning of one or more of the objects to the processing unit in sequential order until a
- 6 remaining storage capacity and a remaining load capacity of the processing unit is too
- 7 small for any of the remaining objects of the sequence; and ("The Next-Fit (NF)
- 8 algorithm takes the next d-capacity item X_i and attempts to place it in the current bin B_k .
- 9 If it does not fit then a new bin, B_{k+1} is started." page 5 paragraph 3)
- 10 removing the objects from the sequence;
- 11 d) determining a load and capacity balance between the processing units of the cluster,
- 12 the determining comprising: ("In past massively parallel processing systems, such as
- 13 the TMC CM-5 and the CRI T3E, the scheduling problems consisted of allocating a
- 14 single type of resource among the waiting jobs; the processing node. A Job was
- 15 allocated the minimum number of nodes required to meet its largest resource
- 16 requirement (e.g. memory, CPUs, I/O channels, ect.)." Leinberger Abstract)
- 17 Leinberger does not teach:
- 18 determining a first threshold and a second threshold of each of the processing units
- 19 based on a number of the processing units;
- 20 calculating a new remaining storage capacity as a difference between the first threshold
- 21 and an aggregated size of objects assigned to the processing unit;
- 22 calculating a new remaining load capacity as a difference between the second threshold

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- 1 and an aggregated load of objects assigned to the processing unit; and
- 2 e) performing step 1 c) again with the new remaining storage capacity and the new
- 3 remaining load capacity

4 Walser teaches:

- 5 determining a first threshold and a second threshold of each of the processing
- 6 units based on a number of the processing units; ("In step 14 an unsatisfied constraint is
- 7 selected" Walser column 5 line 60)
- 8 calculating a new remaining storage capacity as a difference between the first threshold
- 9 and an aggregated size of objects assigned to the processing unit;
- 10 calculating a new remaining load capacity as a difference between the second threshold
- 11 and an aggregated load of objects assigned to the processing unit; and
- 12 e) performing step 1 c) again with the new remaining storage capacity and the new
- 13 remaining load capacity. ("After the variables are initialized, the method iterates through
- 14 a local search process to generate an approximately optimal solution." Walser column 5
- 15 line 57)

16 A person of ordinary skill in the art would have modified Leinberger with the
17 feedback system of Walser by changing the input constraints and fixing a number of
18 iterations. This would have been done by selecting a valid value range for bins and
19 wasted space of Leinberger. The limited set of constraints in bin packing, specifically
20 wasted space, would be an obvious selection for optimization. It would have been
21 obvious at the time the invention was made to a person of ordinary skill in the art

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3 Regarding claims 2, 14, Leinberger teaches; wherein step 1 c) is carried out

4 repeatedly (page 5 paragraph 3) until the sequence is empty. ("Again, the goal is to

5 partition the list L into as few bins Bk as possible." page 5 paragraph 2)

6 Regarding claim 3, Leinberger teaches; wherein the remaining storage capacity

7 is determined by the difference between the storage capacity of the processing unit and

8 the aggregated size of objects being assigned to the processing unit. ("If it does not fit

9 (ie, if $X_{ij} + B_{kj} > C_j$ for some j) then a new bin, B_{k+1} , is started." page 5 paragraph 3)

10 Regarding claim 4, Leinberger teaches; wherein the remaining load capacity is

11 determined by the difference between the load capacity of the processing unit and the

12 aggregated loads of objects being assigned to the processing unit. (page 5 paragraph

13 3)

14 Regarding claims 12, 18, Leinberger teaches; the index of an object is calculated

15 based on the sum of the normalized object size and object load and based on the

16 absolute value of a difference between the normalized object size and the normalized

17 object load. ("In the d-capacity formulation, however, the items are sorted based on a

18 scalar representation of the d components." page 5 paragraph 4)

19 Regarding claim 19, Leinberger teaches; A data processing system for

20 determining a minimum number of processing units of a cluster of processing units for a

21 given number of objects having various object sizes and object loads, the data

22 processing system comprising:

1 means for calculating an index based on object size and object load for each one of the
2 objects, ("In the d-capacity formulation, however, the items are sorted based on a scalar
3 representation of the d components." page 5 paragraph 4)

4 means for assigning of one or more of the objects to a processing unit in sequential
5 order until a remaining storage capacity and/or a remaining load capacity of the
6 processing unit is too small for consecutive objects of the sequence and for deleting of
7 the objects that are assigned to the processing unit from the sequence[[.]] ,and ("The
8 Next-Fit (NF) algorithm takes the next d-capacity item X_i and attempts to place it in the
9 current bin B_k . If it does not fit then a new bin, B_{k+1} is started." page 5 paragraph 3)
10 means for outputting of the minimum number of the processing units. ("Again, the goal
11 is to partition the list L into as few bins B_k as possible." page 5 paragraph 2)
12 d) means for improving a balance between the processing units by ("In past massively
13 parallel processing systems, such as the TMC CM-5 and the CRI T3E, the scheduling
14 problems consisted of allocating a single type of resource among the waiting jobs; the
15 processing node. A Job was allocated the minimum number of nodes required to meet
16 its largest resource requirement (e.g. memory, CPUs, I/O channels, ect.)" Leinberger
17 Abstract)
18 means for determining a first threshold and a second threshold of each of the
19 processing units based on a number of the processing units;
20 means for calculating a new remaining storage capacity as a difference between the
21 first threshold and the aggregated size of objects assigned to the processing unit;
22 means for calculating a new remaining load capacity as a difference between the

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1 second threshold and the aggregated load of objects assigned to the processing unit;

2 and

3 means for performing step 19 b) again with the new remaining storage capacity and the

4 new remaining load capacity. ("If it does not fit (ie, if $X_{ij} + B_{kj} > C_j$ for some j) then a new

5 bin, B_{k+1} , is started." page 5 paragraph 3. alternatively "Initially, bin B1 is created and

6 the first item in the list L, X_1 , is placed into this bin. Next, the list L is scanned from

7 beginning to end searching for the next element X_i which will fit into bin B1. Place each

8 successive X_i which fits into bin B1. When no element is found which will fit, then bin B2

9 is created." Page 6 paragraph 3)

10 Regarding claim 21, Leinberger teaches; A blade server comprising executable

11 instructions, which when executed cause a processor associated with the blade server

12 to execute a method for dynamically assigning objects to a plurality of blade servers,

13 each one of the objects having an assigned index that is based on object size and

14 object load, the method comprising:

15 a) sorting of the objects by index to provide a sequence of objects; ("In the d-capacity

16 formulation, however, the items are sorted based on a scalar representation of the d

17 components." page 5 paragraph 4)

18 b) for each processing unit of the cluster:

19 assigning one or more of the objects to the processing unit in sequential order until a

20 remaining storage capacity and/or a remaining load capacity of the processing unit is

21 too small for any of the remaining objects of the sequence; ("The Next-Fit (NF)

22 algorithm takes the next d-capacity item X_i and attempts to place it in the current bin B_k .

- 1 If it does not fit then a new bin, B_{k+1} is started." page 5 paragraph 3)
- 2 c) removing the assigned objects from the sequence[,]
- 3 d) determining a load and capacity balance between the processing units of the cluster,
- 4 the determining comprising: ("In past massively parallel processing systems, such as
- 5 the TMC CM-5 and the CRI T3E, the scheduling problems consisted of allocating a
- 6 single type of resource among the waiting jobs; the processing node. A Job was
- 7 allocated the minimum number of nodes required to meet its largest resource
- 8 requirement (e.g. memory, CPUs, I/O channels, ect.)." Leinberger Abstract)
- 9 determining a first threshold and a second threshold of each of the processing units
- 10 based on a number of the processing units;
- 11 calculating a new remaining storage capacity as a difference between the first threshold
- 12 and an aggregated size of objects assigned to the processing unit;
- 13 calculating a new remaining load capacity as a difference between the second threshold
- 14 and an aggregated load of objects assigned to the processing unit; and
- 15 e) performing step 21 b) again with the new remaining storage capacity and the new
- 16 remaining load capacity. ("If it does not fit (ie, if $X_{ij} + B_{kj} > C_j$ for some j) then a new bin,
- 17 B_{k+1} , is started." page 5 paragraph 3. alternatively "Initially, bin B1 is created and the
- 18 first item in the list L, X_1 , is placed into this bin. Next, the list L is scanned from
- 19 beginning to end searching for the next element X_i which will fit into bin B1. Place each
- 20 successive X_i which fits into bin B1. When no element is found which will fit, then bin B2
- 21 is created." Page 6 paragraph 3)

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1 Claims 1-4, 12-14, 18, 19, 21, are rejected under 35 U.S.C. 103(a) as being
2 unpatentable over Leinberger et al. as shown in (Multi-Capacity Bin Packing Algorithms
3 with Applications to Job Scheduling under Multiple Constraints), in view of Kang et al.
4 (Algorithms for the variable sized bin packing problem)

5 With respect to claim 1, 13, 19, 21, Leinberger teaches the elements as shown
6 above.

7 Leinberger does not teach:
8 determining a first threshold and a second threshold of each of the processing units
9 based on a number of the processing units;
10 calculating a new remaining storage capacity as a difference between the first threshold
11 and an aggregated size of objects assigned to the processing unit;
12 calculating a new remaining load capacity as a difference between the second threshold
13 and an aggregated load of objects assigned to the processing unit; and
14 e) performing step 1 c) again with the new remaining storage capacity and the new
15 remaining load capacity

16 Kang teaches said elements, "In IFFD (respectively, IBFD), we first allocate all
17 the items to the largest size bins using FFD (respectively, BFD). And get a feasible
18 solution. We then obtain another solution by repacking the items in the last bin of the
19 solution to the next largest bins using FFD (respectively, BFD)." (Kang page 367
20 paragraph 2)

21 A person of ordinary skill in the art would have included the additional iteration of
22 Kang in the invention of Leinberger by repacking the items according to Kang. It would

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1 have been obvious at the time the invention was made to a person of ordinary skill in
2 the art to include Kang in order to reduce the wasted space in a bin.

3 Claims 3-4, 12, 14, 18, are rejected for the reasons detailed above.

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5 Claims 10, 11, 20, and 23 are cancelled.

6

7 ***Response to Arguments***

8 Applicant's arguments, see page 16, filed 12/01/2008, with respect to claims 1,
9 13, 19, 21 under 35 USC 102 have been fully considered and are persuasive. The
10 rejection of claims 1-23 have been withdrawn.

11 Applicant's arguments, see page 16, filed 12/01/2008, with respect to the
12 rejection(s) of claim(s) 1, 13, 19, 21 under 35 USC 102 have been fully considered and
13 are persuasive. Therefore, the rejection has been withdrawn. Leinberger does not
14 teach a repacking or rebalancing of any bins. However, upon further consideration, a
15 new ground(s) of rejection is made in view of Leinberger in view of Walser, and
16 Leinberger in view of Kang.

17 Applicant's arguments, see page 15-16, filed 12/01/2008, with respect to claims
18 5-9, 15-17, 22 have been fully considered and are persuasive. The rejection under 35
19 USC 103 of claims 5-9, 15-17, 22 has been withdrawn. These claims, however, are
20 objected to as depending upon rejected claims.

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Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

4 A shortened statutory period for reply to this final action is set to expire THREE
5 MONTHS from the mailing date of this action. In the event a first reply is filed within
6 TWO MONTHS of the mailing date of this final action and the advisory action is not
7 mailed until after the end of the THREE-MONTH shortened statutory period, then the
8 shortened statutory period will expire on the date the advisory action is mailed, and any
9 extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of
10 the advisory action. In no event, however, will the statutory period for reply expire later
11 than SIX MONTHS from the mailing date of this final action.

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1 Any inquiry concerning this communication or earlier communications from the
2 examiner should be directed to Michael Chao whose telephone number is (571)270-
3 5657. The examiner can normally be reached on 8-4 Monday through Thursday.

4 If attempts to reach the examiner by telephone are unsuccessful, the examiner's
5 supervisor, Andrew Caldwell can be reached on (571)272-3868. The fax phone number
6 for the organization where this application or proceeding is assigned is 571-273-8300.

7 Information regarding the status of an application may be obtained from the
8 Patent Application Information Retrieval (PAIR) system. Status information for
9 published applications may be obtained from either Private PAIR or Public PAIR.
10 Status information for unpublished applications is available through Private PAIR only.
11 For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should
12 you have questions on access to the Private PAIR system, contact the Electronic
13 Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a
14 USPTO Customer Service Representative or access to the automated information
15 system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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17 Examiner, Art Unit 2442

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